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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G06F 13/00, 17/30

A1

(11) International Publication Number: **WO 99/19803**

(43) International Publication Date: 22 April 1999 (22.04.99)

(21) International Application Number: PCT/US98/20173

(22) International Filing Date: 25 September 1998 (25.09.98)

(30) Priority Data:
60/060,655 26 September 1997 (26.09.97) US

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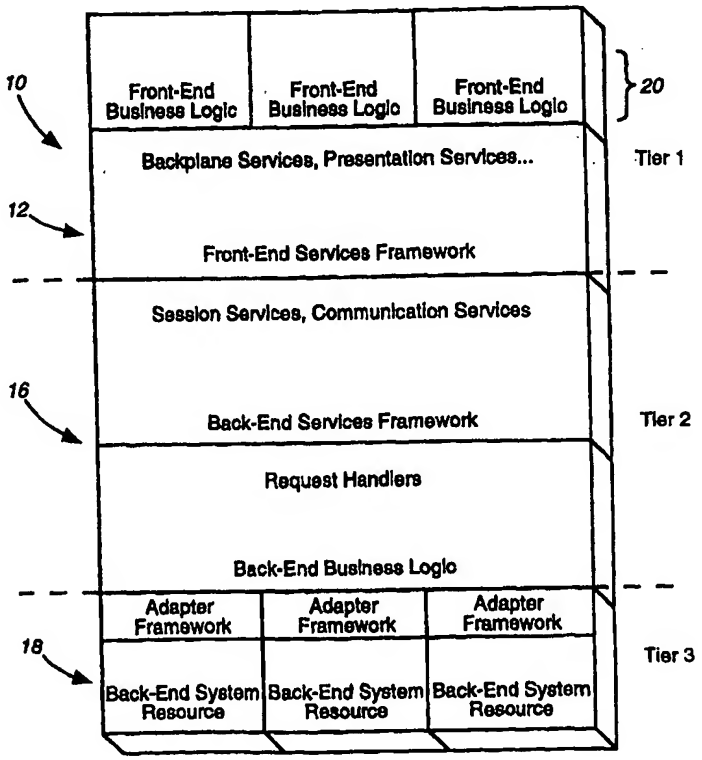
(81) Designated States: AU, BR, CA, JP, MX, SG, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: INTEGRATED CUSTOMER INTERFACE FOR WEB BASED COMMUNICATIONS NETWORK MANAGEMENT

(57) Abstract

A web–based, integrated customer interface system (30) for enabling customer management of their communication network assets. A web–based GUI (20) enables a customer to interact with one or more network management resources and telecommunication services. The integrated interface system (30) includes: 1) a customer's network report management; 2) a centralized in–box system for online notifications to client workstation; 3) a real–time network services monitoring system; 4) broadband system for presenting physical and logical views of data networks and performance information; 5) a toll–free network management system enabling customization of 800/8xx toll free number routing; 6) Outbound Network Management (ONM); 7) packet–switched events monitoring; 8) a trouble ticket tool; 9) web–based invoice reporting for access to billing information; 10) web–based call manager; 11) on–line order entry and administrative service; 12) system for handling security and authentication.



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INTEGRATED CUSTOMER INTERFACE FOR WEB BASED COMMUNICATIONS NETWORK MANAGEMENT

The present invention relates generally to information delivery systems over the public Internet, and, particularly, to a WWW/Internet-based, telecommunications data management service for customers of telecommunications service providers.

In conventional customer enabled reporting and data management systems, a connection is made with a large legacy system via a dial-up connection from a customer owned personal computer or work station. This connection frequently, although not always, emulates a terminal addressable by the legacy system. The dial-up access requires custom software on the customer workstation to provide dial-up services, communication services, emulation and/or translation services and generally some resident custom form of the legacy application to interface with the mid range or main frame computer running the legacy system.

There are several problems associated with this approach:

First, the aforementioned software is very hardware specific, and customers generally have a wide range of workstation vendors, which requires extensive inventory for distribution, and generally, intensive customer hand holding through initial setup and installation before reliable and secure sessions are possible. If the customer hardware platform changes through an upgrade, most of these issues need renegotiation.

Secondly, dial-up, modem, and communications software interact with each other in many ways which are not always predictable to a custom application,

requiring extensive trouble shooting and problem solving for an enterprise desiring to make the legacy system available to the customer, particularly where various telephone exchanges, dialing standards or signal standards are involved.

Third, when an enterprise desires to make more than one system available to the customer, the custom application for one legacy system is not able to connect to a different legacy system, and the customer must generally logoff and logon to switch from one to the other. The delivery technology used by the two legacy systems may be different, requiring different interface standards, and different machine level languages may be used by the two systems, as for example, the 96 character EBCDIC language used by IBM, and the 127 character ASCII language used by contemporary personal computers.

Finally, the security and entitlement features of the various legacy systems may be completely different, and vary from system to system and platform to platform.

In the context of telecommunications services and products offered by large telecommunications network service providers for their customers, the assignee of the present invention, MCI, has deployed an MCI ServiceView ("MSV") platform comprising a number of independent legacy systems enabling dial-up connectivity for those customers desiring to obtain the following network management service and reporting data pertaining to their telecommunications networks: priced call detail data and reporting; toll-free network manager "800NM" call routing data; outbound network management data; trouble ticket information; fault

manager alarms. Limited interactive toll free network control is additionally supported whereby customers may change the configuration of their toll-free networks and "virtual" networks, i.e., Vnet networks. In addition to the MSV platform, the present assignee has implemented a variety of stand alone applications including: a Traffic View system enabling customers to perform real-time network traffic monitoring of their toll-free networks, and obtain near-real time call detail data and reports, and, a "Hyperscope" reporting system for providing reports on the performance of customers' Broadband (data) networks.

More particularly, MCI's ServiceView platform ("MSV") provides for the generation of Toll-free Network Management data, priced call detail ("Perspective") data for usage analysis and trending, each of which requires a different reporting mechanism due to the nature of the data being presented. Such reporting systems typically do not provide any report customization or presentation options for the customer, and any reporting customization is provided by an application specific program running on the client workstation. Furthermore, such systems do not readily provide for the scheduling of periodic or ad hoc "one-shot" reports.

Thus, what is needed is a comprehensive system that facilitates and simplifies customer access to, and management of, all of their telecommunications network assets and enterprise telecommunications network management products and services to which they have subscribed.

The rapid adoption and use of the internet for data exchange has prompted a desire on the part of customers to access their data over the internet.

The popularity of the public Internet provides a measure of platform independence for the customer, as the customer can run their own Internet web-browser and utilize their own platform connection to the Internet to enable service. This resolves many of the platform hardware and connectivity issues in the customers favor, and lets the customer choose their own platform and operating system. Web-based programs can minimize the need for training and support since they utilize existing client software which the user has already installed and already knows how to use, i.e., the browser. Further, if the customer later changes that platform, then, as soon as the new platform is Internet enabled, service is restored to the customer. The connectivity and communications software burden is thus resolved in favor of standard and readily available hardware and the browser and dialup software used by the public Internet connection.

An Internet delivered paradigm obviates many of the installation and configuration problems involved with initial setup and configuration of a customer workstation, since the custom application required to interface with the legacy system can be delivered via the public Internet and run within a standard web-browser, reducing application compatibility issues to browser compatibility issues.

For the enterprise, the use of off-the-shelf web browsers by the customer significantly simplifies the enterprise burden by limiting the client development side to screen layouts and data

presentation tools that use a common interface enabled by the web browser. Software development and support resources are thus available for the delivery of the enterprise legacy services and are not consumed by a need for customer support at the work station level.

It would be highly desirable to provide an integrated system that provides for secure connectivity to telecommunications enterprise legacy systems over the public Internet. The public Internet provides access connectivity world wide via the TCP/IP protocol, without need to navigate various disparate security protocols, telephone exchanges, dialing standards or signal standards, thereby providing a measure of platform independence for the customer.

Furthermore, it would be desirable to provide an Intranet/Internet/Web-based reporting system that provides a common GUI enabling both report requesting, customizing, scheduling and viewing of various types of data from different back-end telecommunications service and applications.

It would also be highly desirable to provide a Intranet/Internet/Web-based data management system infrastructure capable of providing telecommunications products and services data to customer's over the Intranet.

It is therefore desired to provide connectivity to enterprise legacy systems providing telecommunications network management services over the public Internet, as the Internet provides access connectivity world wide via the TCP/IP protocol, without need to navigate various telephone exchanges, dialing standards or signal standards.

The present invention is directed to a Web-based, integrated customer interface system for telecommunications network management. The customer interface system is provided with a graphical user interface for enabling a user to interact with one or more telecommunications network management services provided by remote servers located in a telecommunications service provider's Intranet, and utilizes a Web paradigm to allow easy and convenient access to all of the telecommunications services from the user's perspective.

In the preferred embodiment, the telecommunications products and services delivered to a client workstation having the integrated customer interface include: 1) report requestor, report viewer, and report management applications enabling a customer to request, specify, customize and schedule delivery of reports pertaining to customer's real time "unpriced" call detail data and priced call detail data; 2) centralized inbox system for providing on-line reporting, presentation, and notifications to a client workstation from one or more Intranet application services over an Internet/Intranet network; 3) a real-time monitoring system enabling a customer to monitor call detail statistics and call detail data pertaining to their special service network usage, e.g., 800/8xx toll-free networks; 4) a toll-free network management system enabling customers to define their own 800/8xx toll free number routing plans via the Web/Internet, enabling customers to change and modify their existing 800/8xx toll free number routing plans, and, temporarily change the percent allocation of traffic for a particular 800/8xx toll free number based on

certain criteria; 5) an outbound network management system enabling customers to manage and track features and services associated with their virtual networks ("Vnet") including management of calling party number orders, dialing plan orders, calling card number management, and ID code sets orders; 6) an event monitor system for providing customers with various reports and real-time alarm information relating to their switched-circuit (data and voice) networks in real time or near-real time, including: provision of physical and logical views of customers' Broadband data networks, physical and logical view of Broadband network alarms, and physical and logical performance information relating to the circuits which comprise a customer's Broadband data network, e.g., frame-relay, thus, allowing customers to make informed network management decisions in controlling their business telecommunications networks; 7) a trouble ticket tool enabling a customer to open and monitor trouble tickets relating to network events on an enterprise network; 8) a Web-based invoice reporting system allowing the customers access to their billing and invoice reports associated with network services provided to a customer; 9) a web-based call manager service enabling call center customers to control delivery of toll free calls from the telecommunications enterprise network to call centers, including call centers having multiple automatic call distributors (ACD's); 10) an Internet "online" order entry and administration service to enable customers to manage their telecommunications accounts; and, 11) a system for handling security and authentication requests from both client and server

side of the applications implementing the suite of telecom products and services.

Integrated within the customer interface system is an application backplane unit for controlling and managing the overall user interface system to a number of Web enabled application services. By invoking the backplane unit a user may receive a number of disparate services available from the remote servers.

Each remote telecom service provided includes its own user interface unit, referred to as a client application, independently implemented of one another and the backplane. Although the client applications are independently developed as separate modules, the interface of the present invention integrates the client applications into one unified system, allowing users to access the individual client applications via the backplane unit. Thus, the present invention provides interoperability between each of the client applications and the backplane, as well as among each of the client applications.

Accordingly, the present invention provides an integrated customer interface and web-based delivery system for delivering to customers a number of telecommunications products and services available from remote servers, wherein separate client applications may communicate with one another and with the backplane unit.

Thus, in accordance with the principles of the invention, there is provided an integrated system for providing a plurality of communications network management services and products to a customer over the public internet, the network management services and

products accessible from a client workstation employing a client browser associated with said customer and capable of receiving web based communications from a communications service enterprise, the system comprising: one or more secure web servers for managing one or more secure client sessions over the internet in response to customer entry into the system, each secure web server supporting secure communications with the client workstation; a plurality of client applications integrated within a web-based GUI and downloaded from a secure web server according to pre-determined customer entitlements, each client application for providing a customer interface integrated within the web based GUI and enabling interactive communications with one or more communications network management resources provided by the communications service enterprise via a secure web server; and, each secure web server supporting communication of request messages entered by the customer via the customer interface to the one or more network management resources capable of providing a desired communications network management function, wherein one or more remote application resource processes the request messages and provides responses to the one or more secure web servers for secure uploading to the client browser and display via the integrated customer interface, thereby enabling a customer to manage its communications network assets.

Advantageously, the integrated customer interface implementing an Internet delivered paradigm for telecom network management services obviates many

of the installation and configuration problems involved with initial setup and configuration of a dial-up customer workstation, since the custom application required to interface with the legacy system can be delivered via the public Internet and run within a standard web-browser, reducing application compatibility issues to browser compatibility issues.

Further features and advantages of the invention will become more readily apparent from a consideration of the following detailed description set forth with reference to the accompanying drawings, which specify and show preferred embodiments of the invention, wherein like elements are designated by identical references throughout the drawings; and in which:

Figure 1 illustrates the software architecture component comprising a three-tiered structure;

Figure 2 is a diagrammatic overview of the software architecture of the networkMCI Interact system;

Figure 3 is an illustrative example of a backplane architecture schematic;

Figure 4 depicts the logon process for the nMCI Interact system;

Figures 5(a) and 5(b) illustrate example nMCI Interact system web home pages presenting customer-selectable telecommunications network services to which the client/customer is entitled;

Figure 6 is a flow diagram illustrating the backplane logic process when a user selects a service;

Figure 7 illustrates an architectural overview of the StarOE order entry component of the nMCI Interact system;

Figure 8 is an input process flow diagram, illustrating inputs to the StarOE order entry component of the nMCI Interact system;

Figure 9 is an output process flow diagram, illustrating outputs from the StarOE order entry component of the nMCI Interact system;

Figure 10 is a block diagram depicting the physical architecture of the StarWRS component of networkMCI Interact Reporting system;

Figures 11(a) - 11(c) illustrate flow diagrams depicting the report request/scheduling process 600 implemented by StarWRS Report Manager and Report Requestor tools of the invention;

Figures 12(a)-12(h) illustrate various examples of report requestor screen dialogs enabling user customization of report requests.

Figure 13(a) illustrates an example browser based message center screen dialog;

Figure 13(b) illustrates an example report viewer dialog box used for requesting view of available generated reports;

Figure 14(a) illustrates the primary components implemented in the StarODS priced reporting component 400;

Figure 14(b) depicts generally the process performed by the DSS in fulfilling a priced reporting request received from StarWRS;

Figures 15(a)-15(c) illustrate the end-to-end process 600 for fulfilling priced call detail data report request;

Figure 16 illustrates an example screen display when the StarOE application is launched;

Figure 17 is a sample StarOE screen 1540 for adding and modifying reporting options which are used by the StarWRS;

Figure 18 illustrates the unpriced call detail reporting and real-time traffic monitoring component 500 for nMCI Interact system;

Figure 19 is an general flow diagram of the process by which the TVS server 550 gets data.

Figure 20 is a detailed flow diagram depicting the internal TVS server processes for receiving customer TVS enablement data from order entry and CORE systems;

Figure 21 is a high-level diagram depicting TCR data flow between processes internal to the TVS server;

Figure 22 is a high-level flow diagram depicting TVS unpriced call detail data report generation process;

Figures 23(a)-23(b) illustrate flow charts describing the real-time monitoring process of the invention;

Figures 23(c)-23(j) illustrate example screen displays illustrating the real-time monitoring (RTM) system functionality of the nMCI Interact.

Figure 24 illustrates the particular methodology employed for periodically updating a Web page with updated statistical data;

Figure 25(a) illustrates the high-level design of the Service Inquiry application architecture 2200;

Figures 25(c)-(d) illustrates the Service Inquiry application server architecture 36 interfacing with the Legacy Backend 40(a), CSM/SI through Requester and Receiver objects;

Figures 25(d)-25(m) illustrate examples of SI application dialog windows enabling user creation and querying of trouble tickets;

Figure 25(n) illustrates domain object model (DOM) 2600 implemented in Service Inquiry;

Figure 26 is a general block diagram depicting the physical architecture of the TFNM system components;

Figures 27(a)-27(c) illustrate exemplary screens providing TFNM functionality through option menus;

Figure 27(d) illustrates an example display when the File/Select Corp ID menu option of Figure 27(a) is selected;

Figure 27(e) illustrates an exemplar screen display depicting a hierarchical tree view of an example toll-free number routing plan;

Figure 27(f) illustrates an example IMPL dialog screen enabling the user to generate a TEMP IMPL/IMPL order for a desired Corp Id;

Figure 27(g) illustrates an example QUIK dialog screen enabling the user to generate a TEMP QUIK/QUIK order for a desired Corp Id;

Figure 27(h) illustrates an exemplar screen display showing the results of an order query;

Figure 27(i) illustrates an exemplary screen display showing the options for changing existing network plan routing orders;

Figure 28 is a block diagram depicting the physical architecture of the ONM system 200 of the invention;

Figures 29(a)-29(p) illustrate various examples of ONM web page screen dialogs enabling user interaction with Outbound Network management system;

Figure 30 is a detailed block diagram depicting the physical architecture of the Broadband reporting system component of the present invention;

Figure 31 illustrates those components utilized for Broadband performance reporting;

Figures 32(a)-32(b) illustrate the flow diagrams depicting the Broadband system report creation process 300;

Figure 33 illustrates a process flow diagram depicting various Broadband reporting data retrieval process;

Figures 34(a) - 34(g) depict example graphic reports relating to a customer's Frame Relay (Broadband) network;

Figures 35(a)-35(b) illustrate two example views presented by the Broadband map viewer;

Figure 36 is a block diagram illustrating an overview of the event monitor component of the nMCI Interact System;

Figure 37 illustrates an example of a back-end configuration for the fault management system;

Figure 38 illustrates an architectural view of a fault management host;

Figure 39 is a high level logic flowchart depicting the operation of the event monitor component of the nMCI Interact System;

Figure 40 illustrates a high level overview of the call manager system environment;

Figure 41 illustrates call manager webstation component architecture of the nMCI Interact system, showing interconnections among the components;

Figure 42 illustrates the objects making up the client interface code, in one embodiment of the call manager system;

Figure 43 illustrates one embodiment of the software architecture showing communications between the client 20 and the call manager web server 1132 and its components;

Figure 44 illustrates an example of call manager webstation application physical architecture when one or more call manager web servers 1132 bypass the CMIDS component 1140;

Figure 45 is an example of a CMIDS conceptual model 1140 providing details of the CMIDS software components;

Figure 46 illustrates a back-end process flow for the call manager system component of the present invention;

Figure 47 illustrates an application-level process flow 1250 for the call manager system component of the present invention;

Figure 48 illustrates an example of a call manager webstation application screen including the toolbar and the route writing palette;

Figure 49 shows an example of a system status display;

Figure 50 illustrates an example of a ACD collector administration function screen displayed for providing the user with the ability to view, create, delete and edit ACD collectors;

Figure 51 illustrates an architectural schematic of the online invoicing system 1300 component of nMCI Interact;

Figure 52 is a flow diagram illustrating an online invoicing process flow;

Figure 53(a) is a sample criteria screen launched from the nMCI Interact home page;

Figure 53(b) is a sample screen displaying a list of invoice reports;

Figure 54 is a sample screen displaying an invoice document generated by the online invoicing system component of the invention;

Figure 55 is a flow diagram illustrating an online invoicing back-end server process flow 1400 during document indexing and storing;

Figure 56 is a flow diagram illustrating an online invoicing back-end server process flow when responding to client requests for document presentation;

Figure 57 is a schematic illustration of the message format passed from the user workstation 20 to the secure web server 24 over the public internet;

Figure 58 is a data flow diagram illustrating the present invention's process flow during logon, entitlement request/response, heartbeat transmissions and logoff procedures; and

Figure 59 is a data flow diagram for various transactions communicated in the nMCI Interact system;

Figure 60 is a diagram depicting the physical network architecture of the nMCI Interact system of the present invention;

Figures 61(a) is a schematic illustration showing the message format passed between the Dispatcher server and the application specific proxy; and Figures 61(b) is a schematic illustration of the message format passed between the application specific proxy back to the Dispatcher server.

The present invention is directed to a Web-based, telecommunications network application delivery system for delivering an integrated suite of customer network management tools to customers of telecommunications service providers using a Web browser paradigm. The integrated suite of customer network management tools described herein and provided by the assignee of the present invention, is collectively referred to as the networkMCI Interact system ("nMCI Interact"). Such an integrated suite of Web-based interactive applications provides all of the tools necessary to enable customers to manage their telecommunication assets, quickly and securely, from anywhere in the world.

The nMCI Interact system architecture is basically organized as a set of common components comprising the following:

1) a software architecture detailing the client and server based aspect of nMCI Interact;

2) a network architecture defining the physical network needed to satisfy the security and data volume requirements of the networkMCI System;